foraging interferes with recruitment and growing season biomass by placing livestock in fields of Sahara mustard during early winter (e.g., January).

Plant competition: Establishment of dense cover of exotic annual grasses apparently suppresses this species.

Chemical Control

The extremely early development of this species might make early chemical control a possibility, especially when desirable native species have not yet begun to develop. This should be investigated experimentally.

Bromus madritensis ssp. ***rubens*** (L.) Husnot

Common names: foxtail chess; red brome, compact brome, Spanish brome

Synonymous scientific name: *Bromus rubens*

Closely related California natives: 9

Closely related California non-natives: 13

Listed: CalEPPC Red Alert; CDFA nl

by Matthew L. Brooks

HOW DO I RECOGNIZE IT?

Distinctive Features

Foxtail chess (*Bromus madritensis* ssp. *rubens*) is characterized by a brush-like inflorescence that becomes a distinctive purplish color at maturity. Plants growing in arid regions are generally less robust with a more open and rigid panicle than those growing in mesic regions. Seedlings are bright green and hairy, much like those of cheatgrass (*B. tectorum*), the other common brome grass of arid and semi-arid regions in southwestern North America. At maturity foxtail chess is erect with a panicle of ascending florets on short pedicels arranged roughly equally around the peduncle. Cheatgrass is more spreading, with a panicle of florets that are attached to the peduncle by long, thin pedicels hanging loosely to one side, nodding toward the ground. These characteristics persist for many years and are useful in differentiating these species even after the florets have fallen from the plant. Young plants are green, but foliage and inflorescences become purplish at maturity, fading to light tan during the months following senescence. Areas of foxtail chess infestation can be recognized at a distance by their purplish color. Until recently, foxtail chess was considered a distinct species, *B. rubens*, but it is now generally considered a subspecies of its congener, *B. madritensis* (Wilken and Painter 1993, Sales 1994).

Description

Poaceae. Annual. Stems: erect or ascending culms to 16 in (40 cm), bearing small soft hairs. Leaves: blades and sheaths with small, soft hairs; blade to 4 in (12.5 cm) x 0.2 in (5 mm); ligule to 0.2 in (5 mm), whitish. Inflorescence: to 3 in (75 mm) x 1.5 in (37 mm), stiffly erect, dense, ovoid at the top, wedge-shaped at the base; rachis internodes generally <0.1 in (3 mm); reddish brown to purplish at maturity. Flower: spikelet: 4 to 11-flowered, uppermost sterile and reduced; to 2 in (50 mm); densely crowded; wedge-shaped; soft or stiff hairs; cylindric to slightly compressed; sessile; lower glume 1-veined, to 0.3 in (8 mm); upper glume 3-veined, to 0.4 in (10 mm); both glumes narrow, gradually tapering to a short point, smooth or with soft hairs, and translucent. Floret: lemma to 0.6 in (16 mm) x 0.1 in (3 mm); short stiff hairs rough to the touch; back rounded, lance-shaped, 5-veined; awn to 0.9 in (22 mm) and generally straight; palea shorter than lemma, very narrow. Seeds: caryopsis to 0.4 in (11 mm). Seed lanceolate with short stiff hairs, bounded by palea and lemma with long, rough awn (Munz 1959, Wilken and Painter 1993, Bor 1968, Davis *et al.* 1985).

WHERE WOULD I FIND IT?

Foxtail chess is considered a weedy grass in cultivated lands and waste places in its native range (Davis *et al.* 1985; Bor 1968a) and occupies similar habitats in California (Munz 1959, Wilken and Painter 1993). It is a common weedy species of grassland and scrub habitats in arid and semi-arid regions of California, especially those that have been disturbed by wildfire, livestock grazing, off-road vehicles, or agriculture. It is known to occur throughout most of the state except the Sierra Nevada, Modoc County, and northwestern parts. Foxtail chess is supplanted as the dominant weedy brome grass at higher elevations by cheatgrass, and in more mesic lowland regions by ripgut grass (*Bromus diandrus* Roth). Distribution of foxtail chess in California deserts is limited by mineral nutrients and water, but where moist, nutrient-rich microhabitats occur, populations can be quite large (Brooks 1998). Such microhabitats include areas beneath perennial shrubs, crevices on rocky outcrops, and margins of roads and washes.

WHERE DID IT COME FROM AND HOW DOES IT SPREAD?

Foxtail chess is native to southern Europe, northern Africa, and southwestern Asia, where it occurs from sea level to 4,260 feet (1,300 m) on stony or sandy soils of cultivated fields and rangelands in arid to mesic scrub and steppe regions (Bor 1968a, Jackson 1985). It was established in California by 1848 (Frenkel 1977) and appears to have naturalized there by the 1890s (Davidson 1907). By 1904 it could be found in Kern, Mendocino, Orange, Amador, and Contra Costa counties (Robbins 1940). Foxtail chess was common in the Mojave Desert by 1950 (Hunter 1991) and subsequently spread across the deserts of California into southern Baja California and eastward to Texas. Its spread into the Great Basin appears to be limited by sensitivity to low winter temperatures (Hulbert 1955) or competitive exclusion by cheatgrass.

Long-distance dispersal of foxtail chess is accomplished by seeds that lodge in animal fur and in loosely woven clothing. Short-distance dispersal is aided by wind, which blows seeds along the ground until they settle in eddies behind shrubs or rocks or in depressions in the ground.

WHAT PROBLEMS DOES IT CAUSE?

Altered patterns of wildfire, microhabitat characteristics, and nutrient cycling caused by foxtail chess and competition for soil nutrients and light negatively affect native annual plant populations and revegetated plants (D'Antonio and Vitousek 1992). Foxtail chess is highly flammable and promotes wildfires in desert plant communities where fires historically have been infrequent (Brooks in press, Brooks 1998). Wildfires convert woody perennial scrub into nonnative annual grassland, which in turn promotes further wildfires. In southern California both coastal and desert plant communities are being "type-converted" into annual grassland dominated by foxtail chess and other exotic annual plants (Brooks unpubl. data). Native reptiles such as snakes and desert tortoises are sometimes killed in rapidly moving fires (Fisher and Esque unpubl. data) fueled by this species.

Although foxtail chess is sometimes grazed by livestock, it is not considered a good forage plant and is generally regarded as having no economic value (Bor 1968). Dried florets become entangled in wool, reducing its value, and lodge in digestive tracts of some livestock, sometimes causing death.

HOW DOES IT GROW AND REPRODUCE?

Foxtail chess reproduces by seed only. It is generally considered a winter annual, emerging in early winter following rainfall and remaining largely quiescent until early spring, when rainfall and higher temperatures stimulate growth and flowering. Plants continue to flower until water stress kills them, typically by the middle of May. Populations increase during years of average to high rainfall. During years of low rainfall a high percentage of seedlings die prior to reproducing, thereby depleting the seedbank. Localized populations of foxtail chess can be virtually wiped out following a few years of drought, suggesting that seed dormancy may not last more than two to three years.

Like many successful annual weeds, foxtail chess can survive up to a year near human habitations and agricultural fields, where it receives enough supplemental water to survive through the summer. Biomass of this species can accumulate over many years, producing annual grasslands with a gray thatch of litter under a mass of tan and red erect and bent-over stems. In desert regions stems can remain rooted and upright for one to three years following death of the plant.

HOW CAN I GET RID OF IT?

Physical Control

Manual methods: Seedlings can be pulled before they produce seeds, but this is practical only on a small scale. Hand pulling may be an option to help revegetated plants become established during the initial stages of restoration projects, but seed rain from plants in adjacent areas will recolonize any open habitat.

Prescribed burning: Burning aids the establishment of foxtail chess in most cases. One exception is fire occurring in spring before seeds are fully mature or have otherwise dispersed to the ground. Naturally occurring spring wildfires can reduce the above-ground biomass of foxtail chess while enhancing that of native forbs in both coastal and desert regions of southern California. Temperatures in fires in grassland and scrub habitats easily kill foxtail chess seeds suspended in the flame zone, but often are not high enough to kill seeds located at or below the soil surface (Brooks 1998). Some perennial plants are more vulnerable to fire in spring than in other seasons. However, the high water content of perennials during spring can provide some protection if the intensity of the fire is low.

Biological Control

Insects and fungi: Some species in the genus *Bromus* are susceptible to both viral and fungal infections. A black smut that destroys the inner part of the spikelet, thereby reducing or preventing seed production, is naturally present in wild populations of foxtail chess in California. Unfortunately, this fungus does not reach levels of infestation that significantly affect population size.

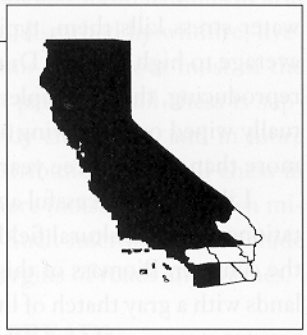
Grazing: Livestock grazing may be used in lieu of hand pulling. Unfortunately, desirable native species are eaten as well, and alterations to the soil caused by livestock may promote further establishment of foxtail chess.

Chemical Control

Various herbicides, including glyphosate, have controlled foxtail chess in agricultural appli-

cations, but they are either not practical to use over the large expanses typically infested by foxtail chess or not currently registered for wildland use.

Bromus tectorum L.



Common names: cheatgrass, downy brome, downy cheat, downy chess, early chess, drooping brome, cheatgrass brome, wild oats, military grass

Synonymous scientific names: none known

Closely related California natives: 9

Closely related California non-natives: 13

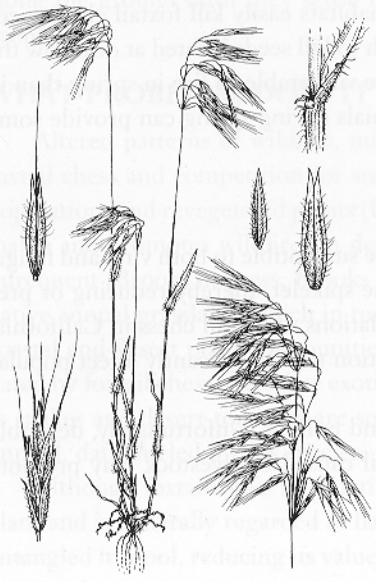
Listed: CalEPPC Red Alert; CDFA nl

by Jim Young

HOW DO I RECOGNIZE IT?

Distinctive Features

Cheatgrass (*Bromus tectorum*) typically is a short grass. Seedlings are bright green with conspicuously hairy leaves, which suggests the alternate common name, downy brome. At maturity the foliage and seedheads often become reddish. After maturity the fine herbage is characterized by a light tan reflectance. The nodding open panicles with moderately awned seeds (caryopses) are distinctive. Seeds readily penetrate clothing of passersby.



Description

Poaceae. Phenotypically extremely variable annual grass. Can mature at 1 in (2.5 cm) high with single floret or at 24 in (60 cm) with multiple tillers and fertile florets. Leaves: leaf sheaf is densely soft-hairy; blade 1/16-1/8 in (0.1-0.5 mm) wide. Leaf blade can be nearly glabrous to dense soft-haired, but is generally softly cillulate near the base. Inflorescence: open to more or less compact panicle with branches usually nodding. Flower: spikelet subcylindric to slightly compressed; glumes glabrous to short-hairy, lower 0.25-0.5 in (5-8 mm), 1-veined, upper 0.33-0.75 in (7-12 mm), 3-veined. Floret: 3 to 7 per spikelet; lemma body 0.33-0.5 in (9-13 mm) long, 5 to 7 veined, glabrous to short-hairy, tip with 2 teeth, 0.07-0.13 in (1-3 mm) long, awn 0.33-0.75 in (8-18 mm) long. Description adapted from Wilken and Painter (1993) and Hitchcock (1950).